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S8292PUS

**Claims**

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1. A laser scanning device, in particular for distance determination having  
a transmission unit (10), which has a pulsed laser for the trans-  
mission of a light beam into a zone to be monitored;  
a light deflection unit (16) to deflect the light beam (12) transmit-  
ted by the pulsed laser into the zone to be monitored;  
a reception unit (10) for the reception of light pulses which are  
reflected by an object located in the zone to be monitored; and  
a front screen (20) which transmits the light beam (12) and  
which separates the transmission unit, the reception unit and the  
light deflection unit (10, 16) from the surroundings of the laser  
scanning apparatus;  
with at least one optical element (22) being provided which splits off  
a part beam (24) from the transmitted light beam and deflects the  
part beam (24) to a photo-detector (10, 28) for a measurement of the  
transmission of the front screen (20).
2. A laser scanning apparatus in accordance with claim 1, character-  
ized in that the optical element (22) is coupled to the front screen  
(20).
3. A laser scanning apparatus in accordance with claim 2, character-  
ized in that the optical element (22) is a separate component which

can be fastened to the front screen (20), in particular to its inner side (26).

4. A laser scanning apparatus in accordance with claim 2, characterized in that the optical element (22) is integrated into the front screen (20).  
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5. A laser scanning apparatus in accordance with claim 2, characterized in that the optical element (22) is a diffractive optical element (20).  
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6. A laser scanning apparatus in accordance with claim 2, characterized in that the optical element (22) is an optical grid (20).
- 15 7. A laser scanning apparatus in accordance with claim 1, characterized in that the at least one photo-detector (28) for the measurement of the intensity of the received part beam (24) is disposed on the side of the front screen (20) remote from the light deflection unit (16).  
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8. A laser scanning apparatus in accordance with claim 1, characterized in that the at least one photo-detector (28) for the measurement of the intensity of the received part beam (24) and the light deflection unit (16) are disposed on the same side of the front screen (20), with the front screen (20) being formed such that the part beam (24) passes through the front screen (20) at least twice.  
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9. A laser scanning apparatus in accordance with claim 7, characterized in that the photo-detector (28) is disposed above or beneath the front screen (20).  
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10. A laser scanning apparatus in accordance with claim 1, characterized in that at least one reflector element (38) is disposed on the side of the front screen (20) remote from the light deflection unit (16).
- 5 11. A laser scanning apparatus in accordance with claim 1, characterized in that at least one reflector element (38) and the light deflection unit (16) are disposed on the same side of the front screen (20), with the front screen (20) being designed such that the part beam
- 10 (24) passes through the front screen (20) at least twice.
12. A laser scanning apparatus in accordance with claim 10, characterized in that at least a part (40) of the part beam (24) can be reflected by the reflector element (38) via the optical element (22) and via the
- 15 light deflection unit (16) into the reception unit (10).
13. A laser scanning apparatus in accordance with claim 11, characterized in that at least a part (40) of the part beam (24) can be reflected by the reflector element (38) via the optical element (22) and via the
- 20 light deflection unit (16) into the reception unit (10).
14. A laser scanning apparatus in accordance with claim 10, characterized in that the reflector element (38) is formed as a reference target.
- 25 15. A laser scanning apparatus in accordance with claim 11, characterized in that the reflector element (38) is formed as a reference target.
16. A laser scanning apparatus in accordance with claim 10, characterized in that the reflector element (38) is disposed above or beneath
- 30 the front screen (20).

17. A laser scanning apparatus in accordance with claim 11, characterized in that the reflector element (38) is disposed above or beneath the front screen (20).
- 5 18. A laser scanning apparatus in accordance with claim 10, characterized in that the reflector element (38) is formed by a retro-reflecting foil.
- 10 19. A laser scanning apparatus in accordance with claim 11, characterized in that the reflector element (38) is formed by a retro-reflecting foil.
- 15 20. A laser scanning apparatus in accordance with claim 1, characterized in that the light deflection unit (16) is made such that a reference beam (32) can be split off from the transmitted light beam (12) and can be deflected in the direction of a reference target (34).
- 20 21. A laser scanning apparatus in accordance with claim 20, characterized in that the reference beam (32) can be transmitted through the light deflection unit (16).
- 25 22. A laser scanning apparatus in accordance with claim 20, characterized in that the reference target (34) is made in a reflecting manner and the light deflection unit (16) is made in a light transmitting manner such that the reference beam can be coupled via the light deflection unit (16) into the reception unit (10) after reflection at the reference target (34).
- 30 23. A laser scanning apparatus in accordance with claim 21, characterized in that the reference target (34) is made in a reflecting manner

and the light deflection unit (16) is made in a light transmitting manner such that the reference beam can be coupled via the light deflection unit (16) into the reception unit (10) after reflection at the reference target (34).

- 5 24. A laser scanning apparatus in accordance with claim 20, characterized in that the reference target (34) is formed by a retro-reflecting foil.
- 10 25. A laser scanning apparatus in accordance with claim 21, characterized in that the reference target (34) is formed by a retro-reflecting foil.
- 15 26. A laser scanning apparatus in accordance with claim 1, characterized in that the light deflection unit (16) includes a planar mirror, in particular a semi-permeable planar mirror.
- 20 27. A laser scanning apparatus in accordance with claim 1, characterized in that the light deflection unit (16) is rotatable about an axis, in particular a vertical axis, in order to monitor a angular range of 360° with the transmitted light beam (12), in particular in a horizontal plane.
- 25 28. A laser scanning apparatus in accordance with claim 20, characterized in that the reference beam (32) can be controlled by an operative switching arrangement such that it is only incident on the reference target (34) at pre-determined angular positions of the light deflection unit (16).

29. A laser scanning apparatus in accordance with claim 21, characterized in that the reference beam (32) can be controlled by an operative switching arrangement such that it is only incident on the reference target (34) at pre-determined angular positions of the light deflection unit (16).
30. A laser scanning apparatus in accordance with claim 28, characterized in that the operative switching arrangement is an optical arrangement rotating with the light deflection unit (16).
31. A laser scanning apparatus in accordance with claim 29, characterized in that the operative switching arrangement is an optical arrangement rotating with the light deflection unit (16).
32. A laser scanning apparatus in accordance with claim 28, characterized in that the operative switching arrangement is a fixed diaphragm and/or shutter arrangement, in particular synchronized with the light deflection unit (16).
33. A laser scanning apparatus in accordance with claim 29, characterized in that the operative switching arrangement is a fixed diaphragm and/or shutter arrangement, in particular synchronized with the light deflection unit (16).
34. A laser scanning apparatus in accordance with claim 32, characterized in that the shutter arrangement is formed by polarization filters or by grid/diaphragm structures rotatable with respect to one another.

35. A laser scanning apparatus in accordance with claim 33, characterized in that the shutter arrangement is formed by polarization filters or by grid/diaphragm structures rotatable with respect to one another.
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36. A method for the monitoring of a front screen (20) of a laser scanning apparatus, in particular in accordance with any one of the preceding claims, in which a part beam (24) is split off from a light beam (12) transmitted by a transmission unit (10), in particular
- 10 comprising a pulsed laser, by an optical element (22), in particular an optical element coupled to a front screen (20), and is deflected through the front screen (20) to determine the transmission of the front screen (20).
- 15 37. A method in accordance with claim 36, characterized in that the intensity of the part beam (24) transmitted through the front screen (20) is measured by means of at least one photo-detector (28).
38. A method in accordance with claim 36, characterized in that at least
- 20 a part (40) of the part beam (24) transmitted through the front screen (20) is reflected back through the front screen (20) and the optical element (22) by means of a reflector element (38) onto a reception unit (10) in which the intensity of the reflected part beam (40) is measured.
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39. A method in accordance with claim 36, characterized in that a reference beam (32) is split off from the transmitted light beam (12) by a light deflection unit (16) and is deflected to a reference target (34) which reflects the reference beam (32) at least partly, with the
- 30 light deflection unit (16) deflecting the reflected reference beam (36)

in the direction of a reception unit (10) in which the intensity of the reflected reference beam (36) is determined.